Summary: Climate Change in Papua New Guinea 2022

Historical and Recent Variability, Extremes and Change

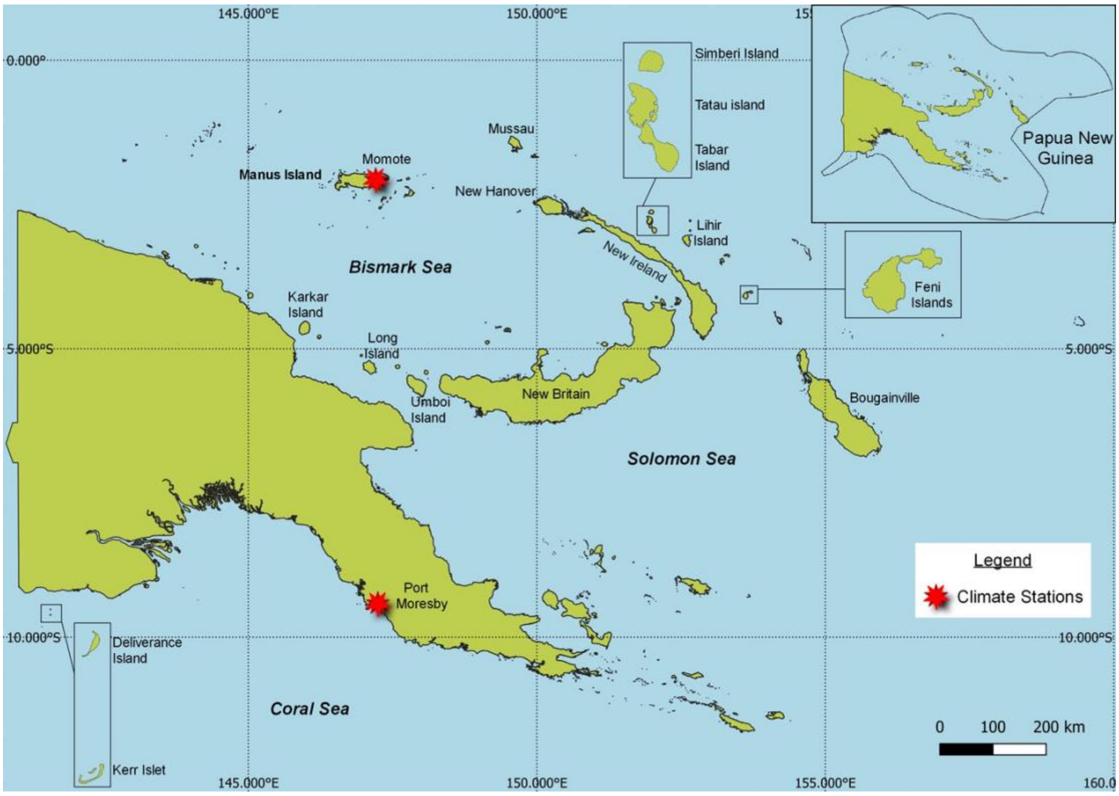
COSPPac
Climate and Oceans Support Program in the Pacific

This brochure provides a snapshot of key long-term changes in climate and ocean variables in Papua New Guinea (PNG). Long-term changes were determined by analysing trends in historical climate and ocean data. Trends provide information about climate change in PNG 'to date'.

Climate variability strongly influences extreme events in PNG. The brochure also provides up–to–date scientific information on climate variability and its influence on extreme events.

Figure 1:

PNG and the location of the climate stations used in Climate Change in the Pacific 2022 report.

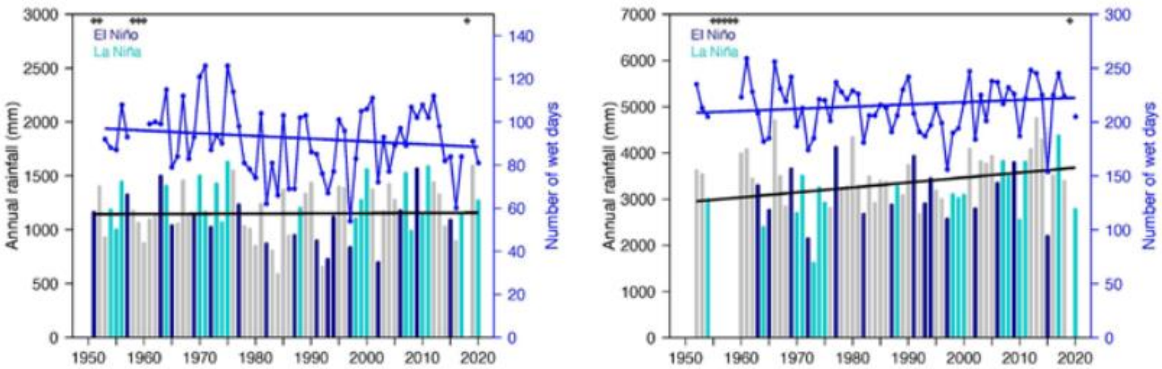


Little change in annual and seasonal rainfall at Port Moresby and Manus Island

Rainfall over Port Moresby is dominated by the West Pacific Monsoon, which brings high rainfall early in the year. Momote (Manus Island) receives almost three times more rainfall than Port Moresby and is strongly influenced by the Intertropical Convergence Zone and the Pacific Warm Pool, which brings consistently high rainfall throughout the year. There has been little change in annual and seasonal rainfall since 1951 at Port Moresby and Momote (Figure 2).

Figure 2:

Annual rainfall (bar graph) and number of wet days (where rainfall is at least 1 mm; line graph) at Port Moresby (left) and Momote (right). Straight lines indicate linear trends for annual rainfall (in black) and number of wet days (in blue). Diamonds indicate years with insufficient data for one or both variables.



There has been little change in extreme rainfall at both locations and little change in meteorological drought at Port Moresby. Substantial variability associated with El Niño Southern Oscillation is evident at both sites. El Niño years are associated with longer dry spells than La Niña years at Port Moresby. Annual rainfall has varied from approximately 600 to 1600 mm at Port Moresby and from approximately 1600 to 4700 mm at Momote.

Air Temperature has increased

Average annual temperatures at Port Moresby have increased by 0.16 °C per decade since 1951. Both daytime and night–time temperatures have increased. Daily minimum temperatures have warmed nearly twice as much as daily maximum temperatures.

The number of hot days and warm nights has increased, and the number of cool days and cold nights has decreased at Port Moresby. Since 1951, the number of hot days has increased by about 5 days per decade. Hot days have a maximum temperature above 31.1–34.4 °C, depending on the time of year.

The number of days where air conditioning is required to cool a building down to 25 °C has increased by 50 days per decade, indicating that energy demand for cooling has increased significantly since 1951.

Long-term increases in both average temperature and temperature extremes in the Pacific are likely driven by human-associated climate change due to the rate of the observed changes and consistency with global trends that have been attributed to climate change (PCCM, 2021).

Tropical cyclone severity has decreased

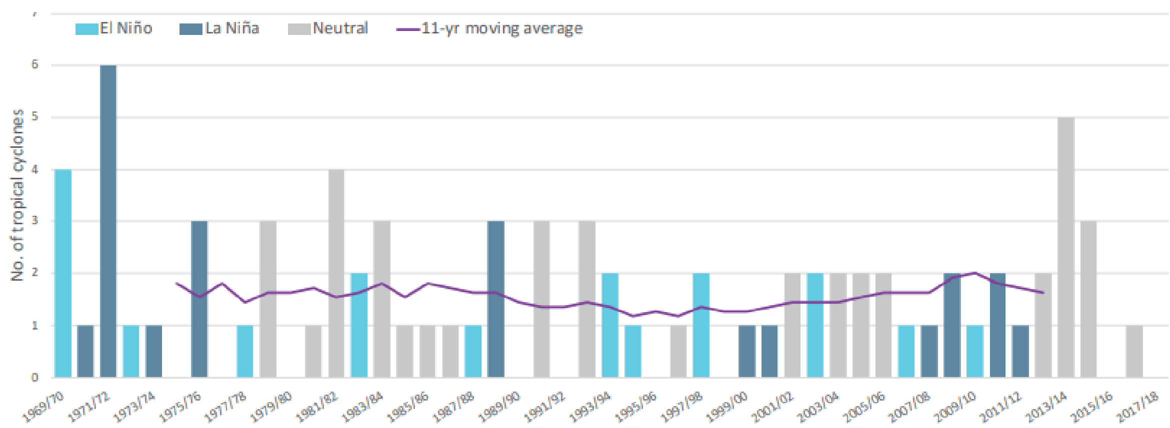
In the greater Southwest Pacific, the total number of **severe** tropical cyclones[1] has decreased over the last 40 seasons. There has been little change in the total number of tropical cyclones of any category in the southwest Pacific. The number of tropical cyclones that became severe events has marginally declined.

Tropical cyclones usually affect PNG during the southern hemisphere tropical cyclone season, which is from November to April, but also occasionally occur outside the tropical cyclone season.

The number of tropical cyclones occurring in PNG's Exclusive Economic Zone (EEZ) varies considerably from one year to the next, ranging from zero in some seasons to six in 1971/72 and five in 2013/14 (Figure 3). Tropical cyclones were most frequent in neutral years (18 cyclones per decade), followed by La Niña years (16 cyclones per decade) and least frequent in El Niño years (14 cyclones per decade).

Figure 3:

Number of tropical cyclones passing within the PNG EEZ per season. Each season is defined by the ENSO status, with light blue being an El Niño year, dark blue a La Niña year and grey showing a neutral ENSO year. The 11–year moving average is presented as a purple line and considers all years.



Due to this high interannual variability and the relatively small number of tropical cyclones passing through any country's EEZ since reliable records began, individual country analysis of long-term trends in frequency and intensity is not possible.

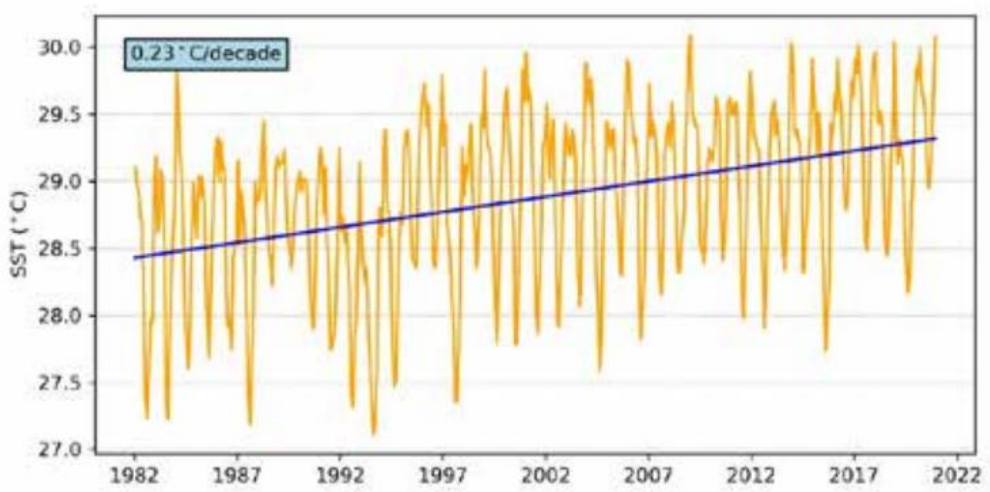
[1] A 'severe' tropical cyclone is defined as having a minimal central pressure of <970 hectopascals (hPa). Pressure is often used when comparing intensity of tropical cyclones.

Sea surface temperature has increased

Sea surface temperatures averaged across PNGs EEZ increased by 0.23 °C per decade since 1982 (Figure 4).

Figure 4:

Sea surface temperature from satellite observations averaged across the PNG EEZ, shown as the orange line. The blue line shows the linear regression trend.



Globally, sea surface temperature is one of the most widely used indicators used to monitor human-associated climate change. Modes of climate variability influence sea surface temperatures on an interannual and decadal/multi-decadal basis; however, climate change is a driver of the long-term positive trend (PCCM, 2021).

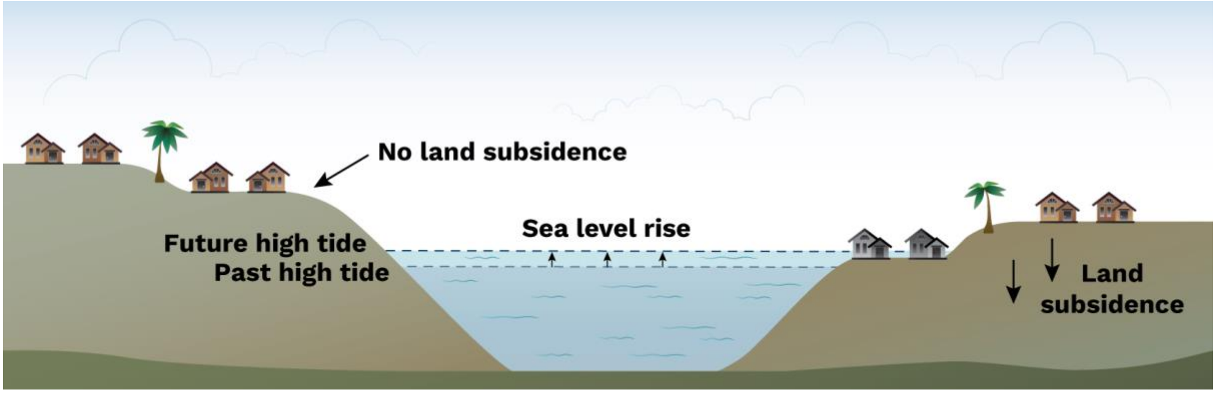
Sea surface temperatures at the Lombrum tide gauge tend to be warmest in November, reaching, on average, a maximum of 31 °C and coolest in February, reaching, on average, a minimum of 30 °C. Hourly temperatures can be up to 2 °C higher or lower than these monthly averages at Lombrum and may differ at other locations in PNG.

Sea level has increased

A combination of sea level rise and land subsidence has increased sea level at the Lombrum (Manus Island) tide gauge by 5.1 mm per year since 1993 (Figure 4). Peak sea levels typically occur between November and February, but they are mostly confined to December/January. La Niña years typically have higher sea levels in December and January. During the 2021 La Niña, sea levels exceeded 1.29 m (the historical 99th percentile) about as many times as they had in the previous 26 years.

Figure 5:

The effect of sea level rise and land subsidence on local sea level.



The long-term trend in sea level across PNG's EEZ is 2.5–5 mm per year since 1993. The highest estimates are in the east and southwest (around Torres Strait and the Gulf of Papua).

The rise in Pacific mean sea level since 1993 is primarily attributable to global warming. Naturally-occurring modes of climate variability in the Pacific region - for example, the El Niño–Southern Oscillation (ENSO) on interannual time scales, and the IPO (Interdecadal Pacific Oscillation)/PDO (Pacific Decadal Oscillation) on decadal to multi-decadal time scales - influence sea level and can amplify or dampen the underlying trends arising from global warming (PCCM, 2021).

Afternoon fishing in PNG

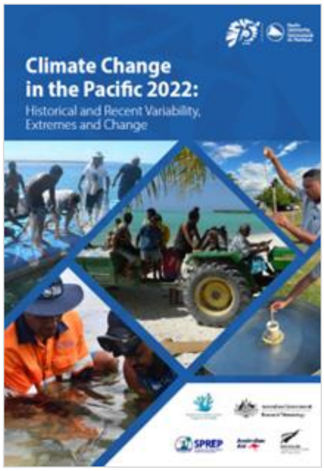
Waves

Waves at Madang come from the northeast to the east. On average, Madang experiences approximately two extreme wave events – defined as reaching or exceeding a wave height of 1.23 m per year.

There has been no long-term change in average annual wave height since 1979. Wave height, wave period (the time interval between two waves) and wave direction changes from month to month with the seasons and, to a lesser degree, year to year with climate variability modes.

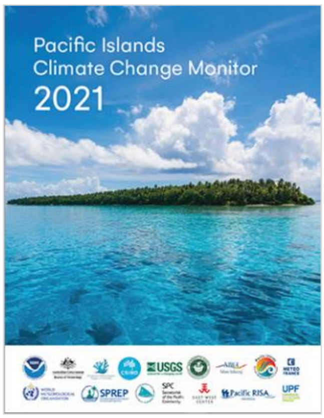
Further reading

For more information, refer to Climate Change in the Pacific 2022: Historical and Recent Variability, Extremes and Change. Climate and Oceans Support Program in the Pacific. Fifteen country chapters are available at https://purl.org/spc/digilib/doc/kskiv



For more information on Pacific-wide observed and future trends in climate indicators, see the Pacific Islands Climate Change Monitor 2021, available at https://www.pacificmet.net/sites/default/files/inline-files/documents/PICC%20Monitor_2021_FINALpp_0.pdf

Historical climate trends and basic climate information from observation sites across the Pacific Islands are available through the web-based Pacific Climate Change Data Portal at www.bom.gov.au/climate/pccsp



Information about future climate change can be found in the 'NextGen' Projections for the Western Tropical Pacific country reports https://www.csiro.au/en/research/environmental-impacts/climate-change/pacific-climate-change-info

Tropical rainforest in PNG

The content of this brochure is an outcome of the high degree of cooperation and collaboration that exists between the implementing partners of the Australian Aid funded Climate and Oceans Support Program in the Pacific (COSPPac), specifically the Bureau of Meteorology (the Bureau), the Pacific Community (SPC) and Pacific Regional Environmental Programme (SPREP), together with the valuable ongoing support from the national meteorological services in the 15 partner countries and territories. Publication support has been provided through New Zealand Aid Programme.

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For more detailed information on the climate of Paupa New Guinea and the Pacific, see:
McGree, S., G. Smith, E. Chandler, N. Herold, Z. Begg, Y. Kuleshov, P. Malsale and M. Ritman. 2022. Climate Change in the Pacific 2022: Historical and Recent Variability, Extremes and Change. Climate and Oceans Support Program in the Pacific. Pacific Community, Suva, Fiji.

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